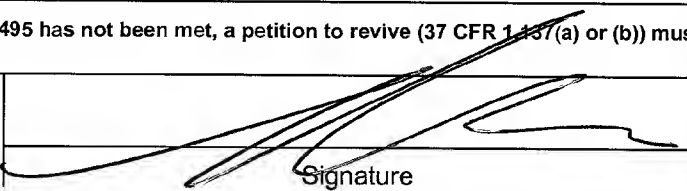


02 AUG 2001

<b>FORM PTO-1390 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE (REV 10-94)</b> <b>TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)</b> <b>CONCERNING A FILING UNDER 35 U.S.C. 371</b>		<b>ATTORNEY'S DOCKET NUMBER</b> 000026.00030 <b>U.S. APPLICATION NO.</b> <b>09/890581</b> Not yet assigned
<b>INTERNATIONAL APPLICATION NO.</b> PCT/GB00/00325	<b>INTERNATIONAL FILING DATE</b> 4 February 2000	<b>PRIORITY DATE CLAIMED</b> 5 February 1999
<b>TITLE OF INVENTION</b> ACTUATING AND LOCKING MECHANISM FOR A SURGICAL TOOL		
<b>APPLICANT(S) FOR DO/EO/US</b> Ian Trevor DAMPNEY, and John Ewant Alfred WICKHAM		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
1.	<input checked="" type="checkbox"/>	This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.
2.	<input type="checkbox"/>	This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.
3.	<input type="checkbox"/>	This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4.	<input checked="" type="checkbox"/>	A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5.	<input checked="" type="checkbox"/>	A copy of the International Application is filed (35 U.S.C. 371(c)(2))
	a. <input type="checkbox"/>	is transmitted herewith (required only if not transmitted by the International Bureau).
	b. <input checked="" type="checkbox"/>	has been transmitted by the International Bureau.
	c. <input type="checkbox"/>	is not required, as the application was filed in the United States Receiving Office (RO/US)
6.	<input type="checkbox"/>	A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7.	<input checked="" type="checkbox"/>	Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
	a. <input type="checkbox"/>	are transmitted herewith (required only if not transmitted by the International Bureau).
	b. <input checked="" type="checkbox"/>	have been transmitted by the International Bureau
	c. <input type="checkbox"/>	have not been made; however, the time limit for making such amendments has NOT expired.
	d. <input type="checkbox"/>	have not been made and will not be made.
8.	<input type="checkbox"/>	A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9.	<input checked="" type="checkbox"/>	An unexecuted oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10.	<input type="checkbox"/>	A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).
<b>Items 11. to 16. below concern document(s) or information included:</b>		
11.	<input type="checkbox"/>	An Information Disclosure Statement under 37 CFR 1.97 and 1.98
12.	<input type="checkbox"/>	An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13.	<input checked="" type="checkbox"/>	A <b>FIRST</b> preliminary amendment.
	<input type="checkbox"/>	A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.
14.	<input type="checkbox"/>	A substitute specification.
15.	<input type="checkbox"/>	A change of power of attorney and/or address letter.
16.	<input checked="" type="checkbox"/>	Other items or information: PCT Demand International Publication Number WO 00/45718 w/International Search Report International Preliminary Examination Report with Annexes PCT Request

<b>U.S. APPLICATION NO.</b> <div style="font-size: 2em; font-weight: bold;">09/890581</div> <div style="font-size: 0.8em;">Not yet assigned</div>		<b>INTERNATIONAL APPLICATION NO.</b> PCT/GB00/00325		<b>ATTORNEY'S DOCKET NO.</b> 000026.00030		
17. <input checked="" type="checkbox"/> The following fees are submitted:				<b>CALCULATIONS</b> PTO USE ONLY		
<b>BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):</b>						
<input checked="" type="checkbox"/> Search Report has been prepared by the EPO or JPO .....\$860.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) .....\$690.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$710.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO .....\$1000.00 International preliminary examination fee paid to USPTO (37 CFR 1.402) and all claims satisfied provisions of PCT Article 33(2)-(4) .....\$100.00						
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>				\$860.00		
Surcharge of \$130.00 for furnishing the oath or declaration later than 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$130.00		
<b>CLAIMS</b>	<b>NUMBER FILED</b>		<b>NUMBER EXTRA</b>	<b>RATE</b>		
Total Claims	25	- 20 =	5	X \$18.00	\$90.00	
Independent Claims	2	- 3 =	0	X \$0.00	\$n/a	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ \$270.00	\$n/a	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$1,080.00		
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				\$n/a		
<b>SUBTOTAL =</b>				\$1,080.00		
Processing fee of \$130.00 for furnishing the English translation later than 20 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				+	\$0.00	
<b>TOTAL NATIONAL FEE =</b>				\$1,080.00		
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28,3.31). \$40.00 per property				+	\$0.00	
<b>TOTAL FEES ENCLOSED =</b>				\$1,080.00		
<b>Amount to be refunded:</b>				\$		
<b>charged:</b>				\$		
a. <input checked="" type="checkbox"/> A check in the amount of \$1,080.00 to cover the above fees is enclosed. b. Please charge my Deposit Account No. _____ in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>23-2185</u> . A duplicate copy of this sheet is enclosed.						
<b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.497(a) or (b)) must be filed and granted to restore the application to pending status.</b>						
<b>SEND ALL CORRESPONDENCE TO:</b> <b>CUSTOMER NO.: 002779</b> <b>BLANK ROME COMISKY &amp; MCCAULEY LLP</b> <b>The Farragut Building</b> <b>900 - 17th Street, N.W., SUITE 1000</b> <b>Washington, D.C. 20006</b>				 Signature		
				NAME		Michael C. Greenbaum
				Registration No.		28,419
				Date		August 2, 2001

09/890581

JC05 Rec'd PCT/PTO 02 AUG 2001

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re U.S. patent application of	:	
	)	
Ian Trevor DAMPNEY, and	:	Group Art Unit: Not yet assigned
John Ewant Alfred WICKHAM	)	
	:	
Serial No.: Not yet assigned	)	Examiner: Not yet assigned
	:	
Filing Date: August 2, 2001	)	Attorney Docket: 000026.00030
	:	MCG/mas
Int'l Appln. No. PCT/GB00/00325	)	
	:	
Int'l. Filing Date: 4 February 2000	)	
	:	
For: <b>ACTUATING AND LOCKING</b>	)	
<b>MECHANISM FOR A</b>	:	
<b>SURGICAL TOOL</b>	)	

**PRELIMINARY AMENDMENT**

Commissioner of Patents  
Box PCT  
Washington, D.C. 20231

Sir:

Prior to an examination on the merits of the above-referenced patent application, please amend this application as follows.

**IN THE CLAIMS:**

Please cancel claims 10, 16, and 28.

Please amend claims 3-4, 6-8, 14, 17, 20, 23, and 26-27 as follows:

3. (Amended) An actuating mechanism according to claim 1, wherein the cage is adapted such at inward radial movement of the cage causes the actuating device to be placed into its actuated position.

4. (Amended) An actuating mechanism according claim 1, wherein the actuating mechanism further comprises a locking mechanism for locking the actuating device in its actuated position.

6. (Amended) An actuating mechanism according to claim 4, wherein the locking mechanism further comprises release means for unlocking the actuating device from its actuated positions into its rest position.
7. (Amended) An actuating mechanism according to claim 4, wherein the actuating mechanism further comprises override means for returning the actuating device from its actuated position to its rest position in the event of the surgical tool becoming jammed.
8. (Amended) An actuating mechanism according to claim 1, wherein the actuating mechanism further comprises biasing means for biasing the actuating device in its rest position.
14. (Amended) A locking mechanism according to claim 11, wherein the locking mechanism further comprises release means for releasing the interengaging means from its locked position into an unlocked position.
17. (Amended) A surgical instrument comprising an handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising an actuating mechanism according to claim 1.
20. (Amended) A surgical instrument according to claim 17, wherein the elongate shaft comprises an actuator rod slideably mounted, within an outer tube, the actuating device actuating the surgical tool by respective longitudinal movement between the actuator rod and the outer tube.
23. (Amended) A surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising a locking mechanism according to claim 11.

- 3 -

**REMARKS**

Claims 10, 16, and 28 have been cancelled. Applicants retain all rights to the subject matter covered by the cancelled multiple dependent claims by making these claims directly dependent on a single claim. The subject matter now not included in these claims may be reintroduced as multiple dependent claims or as separate independent or dependent claims in the present application or in a continuation and/or divisional application.

Applicants also understand that, under the procedures of the PCT, a copy of the priority document (GB 9902647.8) has been supplied to the U.S. Patent & Trademark Office pursuant to Rule 17 of the PCT Regulations. It is, therefore, respectfully requested that the first Official Action in the present application contain an indication that the appropriate priority document is in the file of this application.

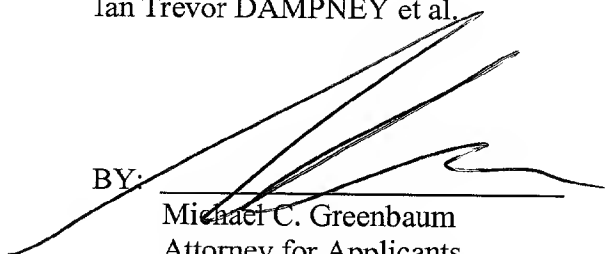
Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with Markings to Show Changes Made.**"

Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

Ian Trevor DAMPNEY et al.

BY:

  
Michael C. Greenbaum  
Attorney for Applicants  
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Telephone: (202) 530-7400  
Date: August 2, 2001

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

Claims 10, 16, and 28 have been cancelled.

3. (Amended) An actuating mechanism according to claim 1 ~~or 2~~, wherein the cage is adapted such at inward radial movement of the cage causes the actuating device to be placed into its actuated position.

4. (Amended) An actuating mechanism according to ~~any one of the preceding claims~~ claim 1, wherein the actuating mechanism further comprises a locking mechanism for locking the actuating device in its actuated position.

6. (Amended) An actuating mechanism according to claim 4 ~~or 5~~, wherein the locking mechanism further comprises release means for unlocking the actuating device from its actuated positions into its rest position.

7. (Amended) An actuating mechanism according to ~~any one of claims 4 to 6~~ claim 4, wherein the actuating mechanism further comprises override means for returning the actuating device from its actuated position to its rest position in the event of the surgical tool becoming jammed.

8. (Amended) An actuating mechanism according to ~~any one of the preceding claims~~ claim 1, wherein the actuating mechanism further comprises biasing means for biasing the actuating device in its rest position.

14. (Amended) A locking mechanism according to ~~any one of claims 11 to 13~~ claim 11, wherein the locking mechanism further comprises release means for releasing the interengaging means form its locked position into an unlocked position.

17. (Amended) A surgical instrument comprising an handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising an actuating mechanism according to ~~any one of claims 1 to 10~~ claim 1.

20. (Amended) A surgical instrument according to ~~any one of claims 17 to 19~~ claim 17, wherein the elongate shaft comprises an actuator rod slideably mounted, within an outer tube, the actuating device actuating the surgical tool by respective longitudinal movement between the actuator rod and the outer tube.

23. (Amended) A surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising a locking mechanism according to ~~any one of claims 11 to 16~~ claim 11.

26. (Amended) A surgical instrument according to ~~any one of claims 17 to 25~~ claim 17, wherein the handle is elongate to enable it to be held in a pen-like grip.

27. (Amended) A surgical instrument according to ~~any one of claims 17 to 2~~ claim 17, wherein the surgical tool comprises miniaturised forceps, clamps, scissors or diathermy hooks.



Claims:

1. An actuating mechanism for actuating a surgical tool of a surgical instrument comprising an actuating device having an actuator surface whereby the actuating device is operable by applying a force to substantially any part of the actuator surface for placing the actuating device in an actuated position from a rest position for actuating a surgical tool, wherein the actuator surface comprises a radially collapsible cage having a plurality of interengaging actuating pads, each pad being movable in a radial direction.
2. An actuating mechanism according to claim 1, wherein each pad has an inwardly extending groove and the actuating device further comprises a plurality of radially extending guides, each guide engaging a respective inwardly extending groove of each pad so that each pad is capable of inward and outward movement in a radial direction.
3. An actuating mechanism according to claim 1 or 2, wherein the cage is adapted such that inward radial movement of the cage causes the actuating device to be placed into its actuated position.
4. An actuating mechanism according to any one of the preceding claims, wherein the actuating mechanism further comprises a locking mechanism for locking the actuating device in its actuated position.
5. An actuating mechanism according to claim 4, wherein the actuating device has a plurality of actuated positions and the locking mechanism is adapted to lock the actuating device in any one of its actuated positions.
6. An actuating mechanism according to claim 4 or 5, wherein the locking mechanism further comprises release means for unlocking the actuating device from its actuated position into its rest position.

7. An actuating mechanism according to any one of claims 4 to 6, wherein the actuating mechanism further comprises override means for returning the actuating device from its actuated position to its rest position in the event of the surgical tool becoming jammed.
8. An actuating mechanism according to any one of the preceding claims, wherein the actuating mechanism further comprises biasing means for biasing the actuating device in its rest position.
9. An actuating mechanism according to claim 8, wherein the biasing means comprises a compression spring.
10. An actuating mechanism for actuating a surgical tool of a surgical instrument substantially as hereinbefore described with reference to any one of the accompanying drawings.
11. A locking mechanism for locking a surgical tool of a surgical instrument in its actuated position comprising interengaging means having a plurality of settings to lock the surgical tool in any one of a plurality of actuated positions, the interengaging means comprising latching means and actuator means wherein the latching means comprises a first stepped surface and the actuator means comprises, a second stepped surface, any one of the steps of the second stepped surface of the actuator means interengaging any one of the steps of the first stepped surface of the latching means to lock the actuator means in any one of a plurality of actuated positions, wherein the axial depth of each step of the second stepped surface of the actuator means is greater than the axial depth of each step of the first stepped surface of the latching means.
12. A locking mechanism according to claim 11, wherein the stepped surface or surfaces are conical.
13. A locking mechanism according to claim 11, wherein the stepped surface or surfaces are spiral.

14. A locking mechanism according to any one of claims 11 to 13, wherein the locking mechanism further comprises release means for releasing the interengaging means from its locked position into an unlocked position.
15. A locking mechanism according to claim 14, wherein the locking mechanism further comprises biasing means for biasing the interengaging means in its unlocked position.
16. A locking mechanism for locking a surgical tool of a surgical instrument substantially as hereinbefore described with reference to any one of the accompanying drawings.
17. A surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising an actuating mechanism according to any one of claims 1 to 10.
18. A surgical instrument according to claim 17, wherein the actuating mechanism is integral with the handle.
19. A surgical instrument according to claim 18, wherein the diameter of the cylindrical surface defined by the actuator surface of the actuating device is approximately equal to the diameter of the handle.
20. A surgical instrument according to any one of claims 17 to 19, wherein the elongate shaft comprises an actuator rod slideably mounted within an outer tube, the actuating device actuating the surgical tool by respective longitudinal movement between the actuator rod and the outer tube.

21. A surgical instrument according to claim 20, wherein the actuating device further comprises means for translating the radial movement of the actuator surface into longitudinal movement for actuating the surgical tool.
22. A surgical instrument according to claim 21, wherein the translation means comprises a plurality of radius arms which extend in an axial direction upon application of the force to a circumferential part of the actuator surface.
23. A surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising a locking mechanism according to any one of claims 11 to 16.
24. A surgical instrument according to claim 23, wherein the elongate shaft comprises an actuator rod slideably mounted within an outer tube, the surgical tool being actuated by respective longitudinal movement between the actuator rod and the outer tube.
25. A surgical instrument according to claim 24, wherein the locking mechanism locks the actuator rod with respect to the outer tube in a plurality of longitudinal positions.
26. A surgical instrument according to any one of claims 17 to 25, wherein the handle is elongate to enable it to be held in a pen-like grip.
27. A surgical instrument according to any one of claims 17 to 26, wherein the surgical tool comprises miniaturised forceps, clamps, scissors or diathermy hooks.
28. A surgical instrument substantially as hereinbefore described with reference to any one of the accompanying drawings.

AMENDED SHEET

6/PRTS

**Actuating and Locking Mechanism for a Surgical Tool**

The present invention relates to an actuating mechanism for actuating a surgical tool of a surgical instrument. It also relates to a locking mechanism for locking a surgical tool of a surgical instrument.

Minimal invasive surgery, known as key hole surgery, has become increasingly popular. The surgery involves making only a small incision in the patient and inserting a specifically designed implement through the incision. The implement comprises a miniaturised surgical implement such as forceps, clamps, scissors or diathermy hooks at the end of a long shaft with a handle attached to the other end for actuating the implement. The implement is inserted so that the handle is outside of the patient and, therefore the surgeon can operate on the patient through the small incision with minimal invasion. This type of surgery minimises the trauma experienced by the patient, reducing post-operation complications and improving patient's recovery time.

Conventionally, the handle of the implement is a scissors-type handle. It has been found that such a handle does not provide steady control and it is difficult to rotate the implement and therefore, it can not easily be manipulated by one hand.

This has been solved by providing a surgical instrument which is held in a pen-like grip. The handle of the instrument extends rearwardly between the surgeon's thumb and forefinger. The instrument can be rotated between the thumb and forefinger so that it can be manipulated easily by one hand and actuation of the tool at the other end of the instrument can easily be achieved by simply applying a force at a point along the handle between the thumb and forefinger.

A known type of instrument, which is held in a pen-like grip, is disclosed by WO 96/24298. The surgical instrument comprises a bulbous portion in which a plurality of discrete flexible actuating members are arranged around the circumference of the bulbous portion of the handle so that the user can depress any one of the actuator elements arranged around the circumference of the handle to actuate the surgical tool. However, it has been found that the bulbous portion of the handle is uncomfortable and the movement of the actuator elements to actuate the surgical tool requires a certain pressure to be applied to them to bring about actuation. This pressure has to be sufficient to overcome the resilience of the actuator members. This pressure can, in certain circumstances, be excessive making fine control of the surgical tool difficult. A further disadvantage is that the flexible actuating members tend to distort under pressure, so that the force output and movement of the instrument is irregular and unpredictable.

Furthermore, this known type of instrument has a mechanism of locking the tool in its actuated position. However, such a mechanism does not provide intermediary positioning of the tool as is sometimes required.

An object of the present invention is to provide a surgical tool in which the above disadvantages are overcome.

According to one aspect of the present invention, there is provided an actuating mechanism for actuating a surgical tool of a surgical instrument comprising an actuating device having an actuator surface whereby the actuating device is operable by applying a force to substantially any part of the actuator surface to place the actuating device in an actuated position from a rest position for actuating a surgical tool, wherein the actuator surface comprises a radially collapsible cage, having a plurality of interengaging actuating pads, each pad being movable in a radial direction.

In providing such an actuator surface, the handle of the surgical instrument is more like a pen which makes it more comfortable when held between the thumb and forefinger. The surface can be cylindrical and as such can be made to move an equidistance at any axial point along the surface. The shape of the actuator members of the prior art, however, means that the central portion has to be moved a greater distance by virtue of the bulbous shape and therefore the actuation of the device of the prior art is less sensitive. The pressure required to actuate the surgical tool by the actuator of the present invention is less and hence fine control of the surgical tool can be achieved.

Each pad may have an inwardly extending groove and the actuating device further comprising a plurality of radially extending guides, each guide engaging a respective inwardly extending groove of each pad so that each pad moves inwardly and outwardly in a radial direction. Preferably, the surgical tool is actuated by inward radial movement of the cage. The actuating mechanism may further comprise means for allowing each pad to move in unison. This may be in the form of a locking collar.

The rib cage provides an actuator surface which is more sensitive since its movement is not dependent on the resiliency of the actuator elements and therefore only a slight pressure needs to be applied to bring about actuation. The rib cage also provides a cylindrical surface which is more comfortable for the user and which is insensitive to radial orientation. Furthermore, the rib cage has a sufficiently rigid structure to resist both circumferential and axial distortion during use.

In a further preferred embodiment, the actuating mechanism comprises a locking mechanism for locking the actuating device in its actuated position. The actuating device may have a plurality of actuated positions and the locking mechanism is adapted to lock the actuating mechanism in any one of its actuated positions. The locking mechanism may further comprise release means for unlocking the actuating device from its actuated position into its rest position.

The actuating mechanism may further comprise override means for unlocking the actuating device from its actuated position to its rest position in an emergency such

as in the event of the effector becoming jammed by tissue in its closed position. The override means may be in the form of a manually operated push button.

In yet a further preferred embodiment, the actuating mechanism comprises biasing means for biasing the actuating device in its unactuated position. The biasing means may comprise a resilient means such as a compression spring.

According to a further aspect of the present invention, there is provided a locking mechanism for locking a surgical tool of a surgical instrument in its actuated position comprising interengaging means having a plurality of settings to lock the surgical tool in any one of a plurality of actuated positions, the interengaging means comprising latching means and actuator means wherein the latching means comprises a first stepped surface and the actuator means comprises a second stepped surface, any one of the steps of the second stepped surface of the actuator means interengaging any one of the steps of the first stepped surface of the latching means to lock the actuator means in any one of a plurality of actuated positions, wherein the axial depth of each step of the second stepped surface of the actuator means is greater than the axial depth of each step of the first stepped surface of the latching means. In a preferred arrangement the axial depth of a step of the stepped surface of the latching means may be an exact multiple of the axial depth of a step of the stepped surface of the actuator means. The stepped surface or surfaces may be conical or spiral, having planar, cylindrical, pyramidal or polygonal shaped steps.

The locking mechanism therefore provides means for setting the surgical tool in a number of different positions so that the tool can be locked at different degrees of actuation which provides accurate control of the instrument during surgery.



In a further preferred embodiment, the locking mechanism comprises release means for releasing the interengaging means from its locked position into an unlocked position.

The locking mechanism may further comprise override means for unlocking the interengaging means in an emergency such as the tool becoming jammed in its closed position and operation of the actuator is sufficient to release it. The override means may be a manually operated push button. The interengaging means may be biased in its unlocked position so that on release of the latching and actuator means, the surgical tool returns to its rest position.

According to a further aspect of the present invention, there is provided a surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising an actuating mechanism described above.

The actuating mechanism of the surgical instrument may be integral with the handle. Further, the diameter of the cylindrical surface defined by the actuator surface of the actuating mechanism may be approximately equal to the diameter of the handle.

The elongate shaft preferably comprises an actuator rod slideably mounted within an outer tube, the surgical tool being actuated by respective longitudinal movement between the actuator rod or the outer tube. The actuating device comprises means for translating the radial movement of the actuator surface into the longitudinal movement for actuating the surgical tool. The translation means may be in the form of a plurality of radius arms which extend in an axial direction upon application of the force to a part of the actuator surface.

According to a further aspect of the present invention, there is provided a surgical instrument comprising a handle, an elongate shaft extending from the handle and an effector mounted on the shaft at a location remote from the handle, the instrument further comprising a locking mechanism described above.

In a preferred embodiment, the elongate shaft comprises an actuator rod slideably mounted within an outer tube, the effector being actuated by respective longitudinal movement between the actuator rod or the outer tube, wherein the locking mechanism locks the actuator rod with respect to the outer tube in a plurality of longitudinal positions.

Preferably, the handle is elongate to enable it to be held in a pen-like grip. The surgical tool may comprise miniaturised forceps, clamps, scissors or diathermy hooks.

The embodiments of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a side elevation of the surgical instrument according to an embodiment of the present invention in the open position;

Figure 2 is a sectional view of the surgical instrument shown in Figure 1 in the open position;

Figure 3 is a sectional view of the actuating mechanism in the open position;

Figure 4 is a sectional view of the surgical instrument of the present invention in the fully closed position;

Figure 5 is a sectional view of the actuating mechanism of a present invention in the fully closed position;

Figure 6 shows the rib cage of the actuating mechanism of the surgical instrument of the present invention unfolded;

Figure 7a shows a sectional view taken along the line 7-7 of Figure 3 of the rib cage of the actuating mechanism of the present invention;

Figure 7b shows a sectional view taken along the line 7-7 of Figure 5 of the rib cage of the actuating mechanism of the present invention;

Figure 8 shows an alternative locking mechanism of the surgical instrument according to the present invention in its locked position; and

Figure 9 shows the alternative locking arrangement of Figure 8 in its locked position.

An embodiment of the present invention will now be described with reference to Figures 1 to 7b. The surgical instrument comprises an elongate handle 1 having a shaft 3 extending from one end thereof. A surgical tool or effector (not shown) is mounted at the distal end of the shaft 3. The shaft 3 is of a conventional construction and comprises a hollow outer tube 5 in which is slideably mounted an actuator rod 7. The surgical tool or effector, for example forceps, is actuated by the reciprocal movement of the actuator rod 7 within the outer tube 5.

The elongate handle 1 comprises an actuator portion 9 which, in use, is grasped between the thumb and forefinger and middle finger in a pen-like grip with the end portion 11 of the handle extending rearwardly between the thumb and forefinger. The actuator 9 comprises a nose portion 13, which has an outer wall 14a which is curved and tapers outwardly towards the end portion 11 of the handle. The nose portion 13 is fixed to the proximal end of the outer tube 5 of the shaft 3. The nose portion 13 has a blind-ended bore 14c coaxial to the longitudinal axis of the shaft 3. The inner wall 14b of the bore 14c tapers inwardly at a steeper angle than the taper of the outer wall 14a and then extends parallel to the longitudinal axis of the shaft 3 and handle 1 forming a cylindrical portion.

A latch 15 is slideably mounted within the bore 14c of the nose portion 13. The latch 15 has an outer wall 16a which is generally cylindrical at one end, the diameter of which is slightly less than the diameter of the cylindrical portion of the bore 14c of the

nose portion 13 so that there is a slight gap between the inner wall 14b of the bore 14c and the outer wall 16a of the latch 15. The outer wall 16a of the latch 15 then tapers outwardly from the cylindrical part of the latch 15 at the same angle as the inner wall 14b of the nose portion 13 such that the gap between the inner wall 14b of the nose portion 13 and the outer wall 16a of the latch 15 is maintained. The inner wall 16b of the latch 15 generally follows the shape of the outer wall 16a. The tapered portion of the inner wall 16b of the latch 15 has a plurality of fine cylindrical steps. The latch 15 extends rearwardly out of the nose portion 13 and has an outwardly extending flange 16c at the distal end thereof. The flange 16c extends outwardly beyond the outer wall 14a of the nose portion 13.

A cylindrical spacer 17 is provided along the cylindrical portion of the inner wall 16b of the latch 15. The spacer 17 is fixedly attached to the base of the bore 14c of the nose portion 13 and extends towards the end portion 11 of the handle beyond the distal end of the latch 15. The spacer 17 is stepped. The latch 15 is therefore sandwiched between the inner wall 14b of the nose portion 13 and the spacer 17 and is slideable therebetween. At the distal end of the spacer, there is located a plurality of radially extending finger pad guides 19. These are more clearly shown in Figures 7a and 7b. The diagrams show six finger pad guides, which are equispaced around the circumference of the outer tube 5 of the shaft 3. Of course, the number of finger pad guides can be varied as required. The finger pad guides 19 extend radially outwardly to slideably engage an inner groove 27 (described below) of a respective finger pad of the actuator 9.

The actuator portion 9 further comprises a rib cage 21, which consists of a plurality of interengaging finger pads 23. The outer surface 24a of the finger pads is curved so that when the finger pads 23 are linked together, they provide a substantially cylindrical surface around the shaft 3. The distal end of each finger pad 23 tapers inwardly at the same angle as the inner wall 16b of the latch 15. The outer surface 24b of the tapered portion is stepped. The axial depth of the steps of the finger pads 23 are greater than the axial depth of the steps of the latch 15. Any one step of the stepped surface 24b of each finger pad 23 interengages any one of the steps of the inner stepped surface 16b of

the latch 15. Each finger pad 23 further comprises an inwardly extending groove 27, which slideably engages a respective finger pad guide 19. At the midpoint of each finger pad 23, there is provided an inwardly extending protrusion 29 against which rests a plurality of radius arms 31, 33. The first radius arm 31 extends inwardly in a forward direction to rest against the forward edge 30a of the protrusion 29 of each finger pad 23 and the rearward edge 20a of its respective finger pad guide 19. The second radius arm 33 extends inwardly and rearwardly from the rearward edge 30b of the protrusion 29 of each finger pad 23 to rest against the forward edge 36a of a drive bush 35. The distal end of each finger pad 23 also tapers inwardly.

The end portion 11 of the handle 1 comprises a generally cylindrical body 37 in which is slideably fitted a thrust yoke 39. The body 37 has a stepped, inner bore 41 so that the inner diameter of the bore 41 of the body 37 increases towards the forward end of the body 37. The thrust yoke 39 is correspondingly stepped to conform to the shape of the bore 41 of the body 37. The shape of the thrust yoke 39 is such that a gap 43 is formed between the bore 41 of the body 37 and the thrust yoke 39. A compression spring 45 is located within the gap 43. The distal end of the thrust yoke 39 has a blind-ended bore 47 in which the actuator rod 7 of the shaft 3 is fixedly attached at one end thereof. The outer tube 5 has a mount 49. The outer tube 5 and mount 49 are slideable with respect to the actuator rod 7 and the bore 47 of the thrust yoke 39.

A generally cylindrical drive bush 35 rests against the forward end of the thrust yoke 39 and is slideable with respect to the outer tube 5 of the shaft 3 and the body 37. The drive bush 35 has an outwardly extending flange 36. An outer guide 51 is fixedly mounted to the forward end of the body 37 to rest against the flange 36 of the bush 35. The outer guide 51 has an inner cam surface 53. An inner guide 55 is fixedly attached within the outer guide 51 having an outer cam surface 55. The inner cam surface 53 of the outer guide 51 and the outer cam surface 57 of the inner guide 55 have a gap therebetween in which a straight T bar or ring 59 fixedly attached to the rearward tapered edge of each finger pad 23 is slideably engaged. The distal end of the thrust yoke 39 extends slightly from the distal end of the body 37 to form an override button 61.

The rib cage 21, in use, is covered with a rubber boot, not shown, to form a sealed unit so that the parts of the actuator portion 9 of the handle 1 is protected from the outside environment.

To actuate the tool, the rib cage 21 is compressed inwardly between the thumb and forefinger of the user from its open position, shown in Figures 2 and 3, into its closed position as shown in Figures 4 and 5. As a result of the interengaging arrangement of the finger pads 23, the rib cage 21 moves synchronously under compression and maintains its cylindrical shape. Compression of the rib cage 21 causes the radius arms 31 and 33 to slide the drive bush 35 and thus the thrust yoke 39 rearwardly. Hence the actuator rod 7 slides rearwardly with respect to the outer tube 5 of the shaft 3 against the bias of the compression spring. On compression of the rib cage 21 the inner groove of each finger pad 23 slides down its respective finger pad guide 19 as shown in Figure 7b and the distal end of each finger pad 23 moves inwardly and due to the stepped surfaces, the latch 15 slides rearwardly up the stepped surface of each finger pad 23 by action of the user's finger or by virtue of a spring and latches at a point along the stepped surface of each finger pad 23 to lock the implement in its actuated position. Since a plurality of steps are provided on each surface, the actuator rod 7 can be locked at a plurality of different longitudinal positions.

To release the surgical tool the latch 15 is moved axially in a forward direction by the user pressing his forefinger against the flange 16c of the latch 15. Each finger pad 23 is then released from the latch 15 and is free to move outwardly to its open, unlocked position along the cam surfaces of the inner and outer guides by the compression spring pushing against the thrust yoke 39. As a result the actuator rod 7 slides with respect to the outer tube 5 and hence release the tool at the end of the shaft 3. To help release the engaged step of the finger pads 23 from the latch 15, the rib cage 21 can be compressed slightly.

In the event that the effector or tool becomes jammed and can not be released by normal action of the device, the effector or tool can be actuated by depression of the

override button 61. The tool can then be released by manually pushing override button 61 to slide the thrust yoke 39 with respect to the body 37 which forces the actuator rod 7 to slide with respect to the outer tube 5 irrespective of the locking mechanism.

An alternative locking mechanism is shown in Figures 8 and 9. The figures illustrate the locking mechanism only, the actuator is not shown. The tool is actuated by sliding the actuator rod 7 with respect to the outer tube 5. It may be utilised in conjunction with the actuator described above or any other suitable actuator.

The handle 1 of the implement houses the actuator (not shown) and locking mechanism. The handle 1 comprises a body 63 having a stepped, inner bore 65. The actuator rod 7 extends through the bore 65 and has an enlarged portion 67 at the distal end thereof. The enlarged portion 67 extends slightly out of the inner bore 65 of the body 63.

The locking mechanism is housed within the enlarged portion of the bore 65 of the body 63. It comprises an upper portion 71, which is fixedly attached to the actuator rod 7 toward the distal end thereof. The upper portion 71 of the lock has a generally cylindrical body with a central bore through which the actuator rod 7 passes. The forward end of the upper portion 71 of the lock comprises a stepped, spiral surface 73. A locking ring 75 is attached to the distal end of the outer tube 5 so that the locking ring 75 can rotate about its axis with respect to the outer tube 5. The locking ring 75 has a complementary stepped spiral surface 77 facing the stepped spiral 73 of the upper portion 71. The locking ring 75 has a pair of diametrically opposing, outwardly extending projections 79. A torsion spring 81 is fixedly attached to one end of the locking ring 75 and the other to the outer tube 5 of the shaft 3 to bias the locking ring rotationally on the axis of the shaft 3.

The locking mechanism also comprises a release ring 83. The release ring 83 is slideable with respect to the shaft 3 and body 63 of the handle 1. The release ring 83 comprises an outer ring portion 85, which has a diameter greater than the diameter of the body of the handle 1. The forward end of the ring portion 85 extends outwardly to a

flange 87. The release ring 83 further comprises an inner ring portion 89, which has a diameter less than the diameter of the bore of the body. The proximal end of the inner ring portion 89 provides a spiral cam surface 91.

The locking mechanism operates to lock the actuator rod 7 in a predetermined position with respect to the outer tube 5 by engagement of the complementary stepped surfaces 73,77 of the upper portion 71 and the locking ring 75. To actuate the tool (mechanism not shown), the actuator rod 7 is caused to slide in a rearward direction with respect to the outer tube 5. As a result the upper portion 71 moves rearwardly with the actuator rod 7. This releases the engagement of the steps and the locking ring 75 can rotate about its axis by virtue of the torsion spring so that the spiral surfaces 73, 77 of the upper portion 71 and the locking ring 75 remain in contact. The inner ring portion 89 of the release ring 83 slides into the bore 65 of the body 63 until the cam surface 91 of the inner ring portion 89 rests on one of the projections 79. To release the actuator rod 7, the outer ring portion 85 is forced to slide axially in a forward direction by the user between their thumb and forefinger. Due to the cam surface 91 running against the projections 79, the locking ring is caused to rotate against the bias of the torsion spring. This causes the locking ring to be released and allows the upper portion 71 to move axially in a forward direction as the stepped surface 73 follows that of the locking ring 75, hence unlocking the device.

The locking mechanism described above and that of the first embodiment can be utilised in conjunction with any known type of actuating mechanism. The stepped surfaces of the locking mechanisms enable the surgical tool to be held in a plurality of settings. Further the actuating mechanism described above can be incorporated with any known type of locking mechanism.

In the light of this disclosure, modifications of the described embodiments as well as other embodiments, all within the scope of the appended claims, will now become apparent to a person skilled in the art.



**Claims:**

1. An actuating mechanism for actuating a surgical tool of a surgical instrument comprising an actuating device having an actuator surface whereby the actuating device is operable by applying a force to substantially any part of the actuator surface for placing the actuating device in an actuated position from a rest position for actuating a surgical tool, wherein the actuator surface comprises a radially collapsible cage having a plurality of interengaging actuating pads, each pad being movable in a radial direction.
2. An actuating mechanism according to claim 1, wherein each pad has an inwardly extending groove and the actuating device further comprises a plurality of radially extending guides, each guide engaging a respective inwardly extending groove of each pad so that each pad is capable of inward and outward movement in a radial direction.
3. An actuating mechanism according to claim 1 or 2, wherein the cage is adapted such that inward radial movement of the cage causes the actuating device to be placed into its actuated position.
4. An actuating mechanism according to any one of the preceding claims, wherein the actuating mechanism further comprises a locking mechanism for locking the actuating device in its actuated position.
5. An actuating mechanism according to claim 4, wherein the actuating device has a plurality of actuated positions and the locking mechanism is adapted to lock the actuating device in any one of its actuated positions.
6. An actuating mechanism according to claim 4 or 5, wherein the locking mechanism further comprises release means for unlocking the actuating device from its actuated position into its rest position.

7. An actuating mechanism according to any one of claims 4 to 6, wherein the actuating mechanism further comprises override means for returning the actuating device from its actuated position to its rest position in the event of the surgical tool becoming jammed.
8. An actuating mechanism according to any one of the preceding claims, wherein the actuating mechanism further comprises biasing means for biasing the actuating device in its rest position.
9. An actuating mechanism according to claim 8, wherein the biasing means comprises a compression spring.
10. An actuating mechanism for actuating a surgical tool of a surgical instrument substantially as hereinbefore described with reference to any one of the accompanying drawings.
11. A locking mechanism for locking a surgical tool of a surgical instrument in its actuated position comprising interengaging means having a plurality of settings to lock the surgical tool in any one of a plurality of actuated positions, the interengaging means comprising latching means and actuator means wherein the latching means comprises a first stepped surface and the actuator means comprises, a second stepped surface, any one of the steps of the second stepped surface of the actuator means interengaging any one of the steps of the first stepped surface of the latching means to lock the actuator means in any one of a plurality of actuated positions, wherein the axial depth of each step of the second stepped surface of the actuator means is greater than the axial depth of each step of the first stepped surface of the latching means.
12. A locking mechanism according to claim 11, wherein the stepped surface or surfaces are conical.
13. A locking mechanism according to claim 11, wherein the stepped surface or surfaces are spiral.

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15

14. A locking mechanism according to any one of claims 11 to 13, wherein the locking mechanism further comprises release means for releasing the interengaging means from its locked position into an unlocked position.
15. A locking mechanism according to claim 14, wherein the locking mechanism further comprises biasing means for biasing the interengaging means in its unlocked position.
16. A locking mechanism for locking a surgical tool of a surgical instrument substantially as hereinbefore described with reference to any one of the accompanying drawings.
17. A surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising an actuating mechanism according to any one of claims 1 to 10.
18. A surgical instrument according to claim 17, wherein the actuating mechanism is integral with the handle.
19. A surgical instrument according to claim 18, wherein the diameter of the cylindrical surface defined by the actuator surface of the actuating device is approximately equal to the diameter of the handle.
20. A surgical instrument according to any one of claims 17 to 19, wherein the elongate shaft comprises an actuator rod slideably mounted within an outer tube, the actuating device actuating the surgical tool by respective longitudinal movement between the actuator rod and the outer tube.

AMENDED SHEET

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16

21. A surgical instrument according to claim 20, wherein the actuating device further comprises means for translating the radial movement of the actuator surface into longitudinal movement for actuating the surgical tool.

22. A surgical instrument according to claim 21, wherein the translation means comprises a plurality of radius arms which extend in an axial direction upon application of the force to a circumferential part of the actuator surface.

23. A surgical instrument comprising a handle, an elongate shaft extending from the handle and a surgical tool mounted on the shaft at a location remote from the handle, the instrument further comprising a locking mechanism according to any one of claims 11 to 16.

24. A surgical instrument according to claim 23, wherein the elongate shaft comprises an actuator rod slideably mounted within an outer tube, the surgical tool being actuated by respective longitudinal movement between the actuator rod and the outer tube.

25. A surgical instrument according to claim 24, wherein the locking mechanism locks the actuator rod with respect to the outer tube in a plurality of longitudinal positions.

26. A surgical instrument according to any one of claims 17 to 25, wherein the handle is elongate to enable it to be held in a pen-like grip.

27. A surgical instrument according to any one of claims 17 to 26, wherein the surgical tool comprises miniaturised forceps, clamps, scissors or diathermy hooks.

28. A surgical instrument substantially as hereinbefore described with reference to any one of the accompanying drawings.

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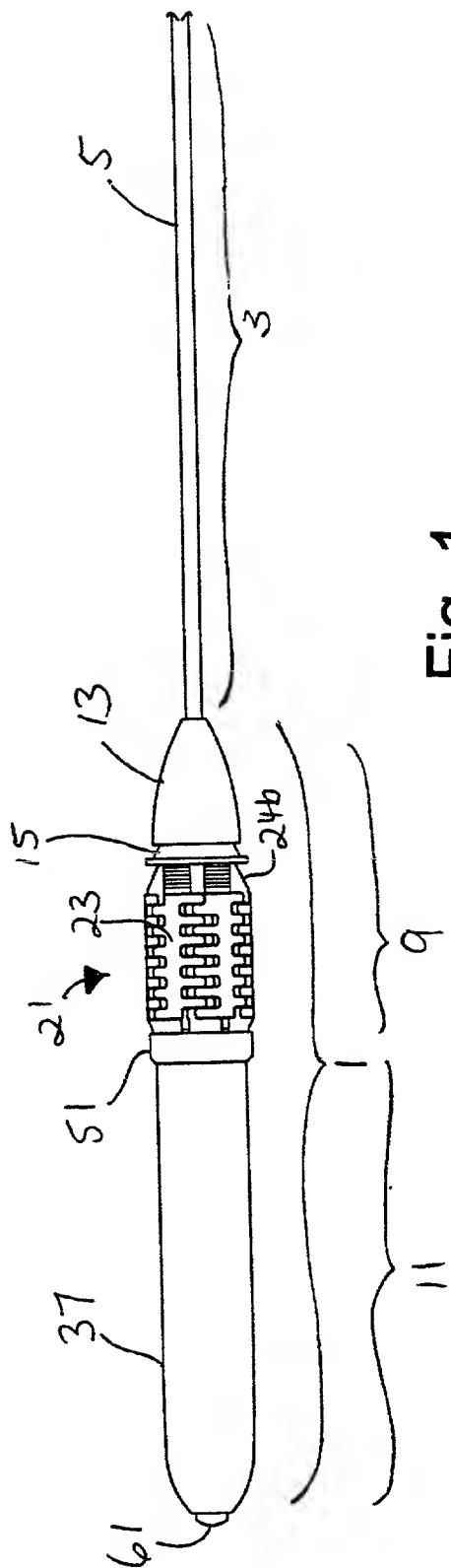


Fig. 1

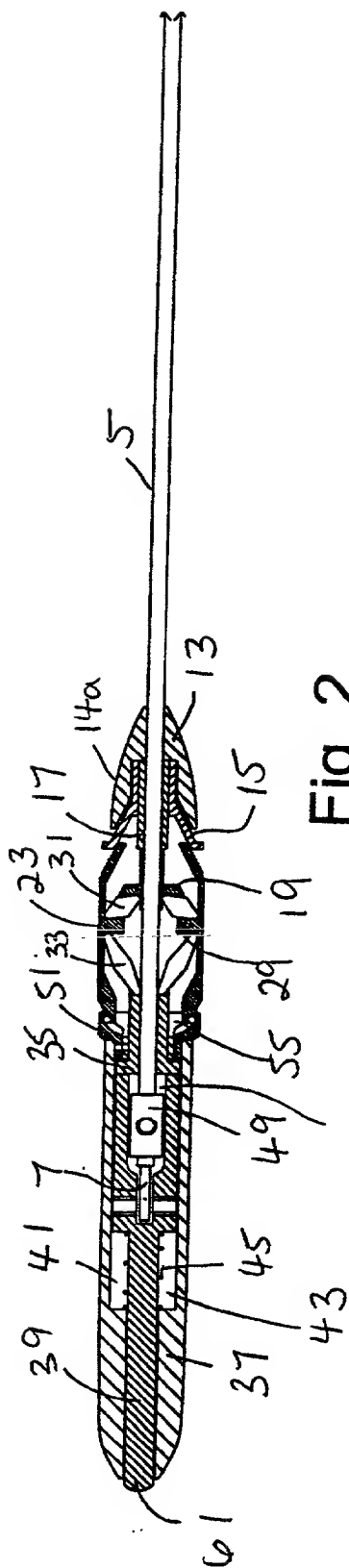


Fig. 2

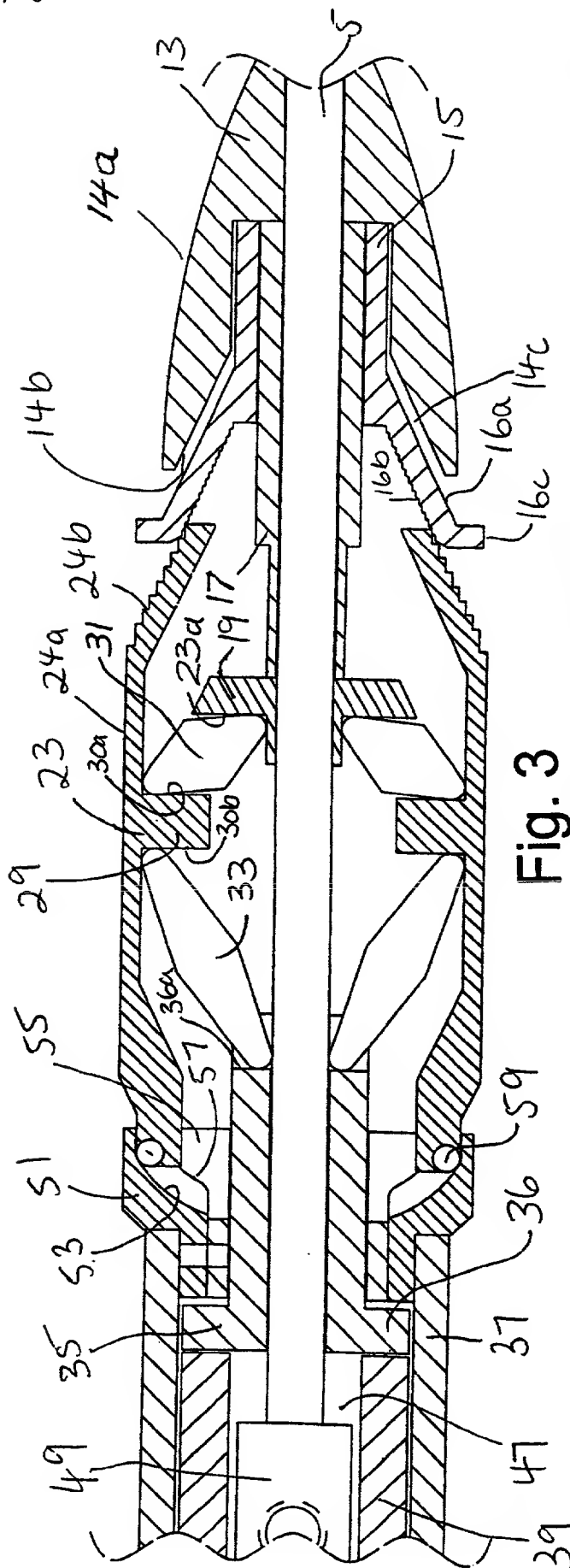


Fig. 3

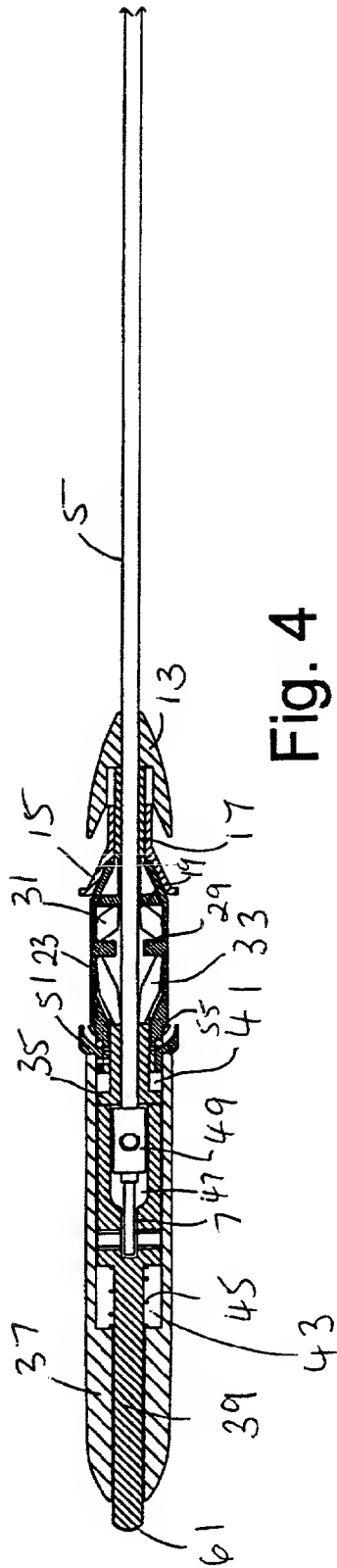


Fig. 4

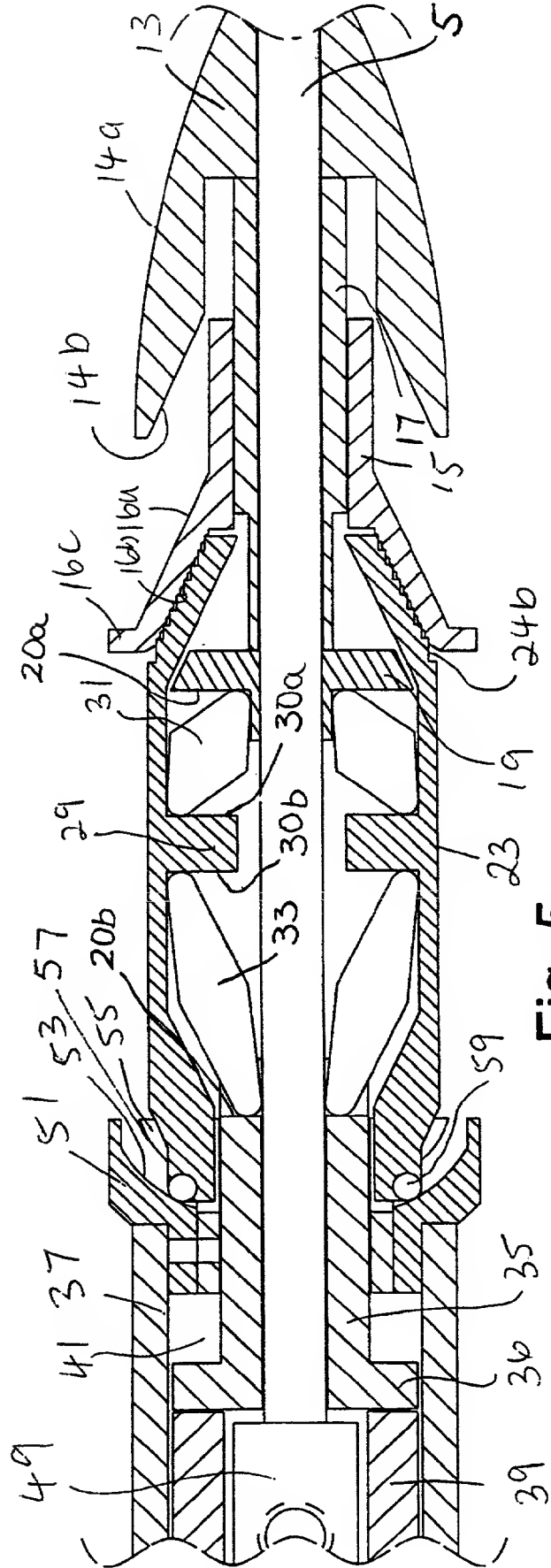


Fig. 5

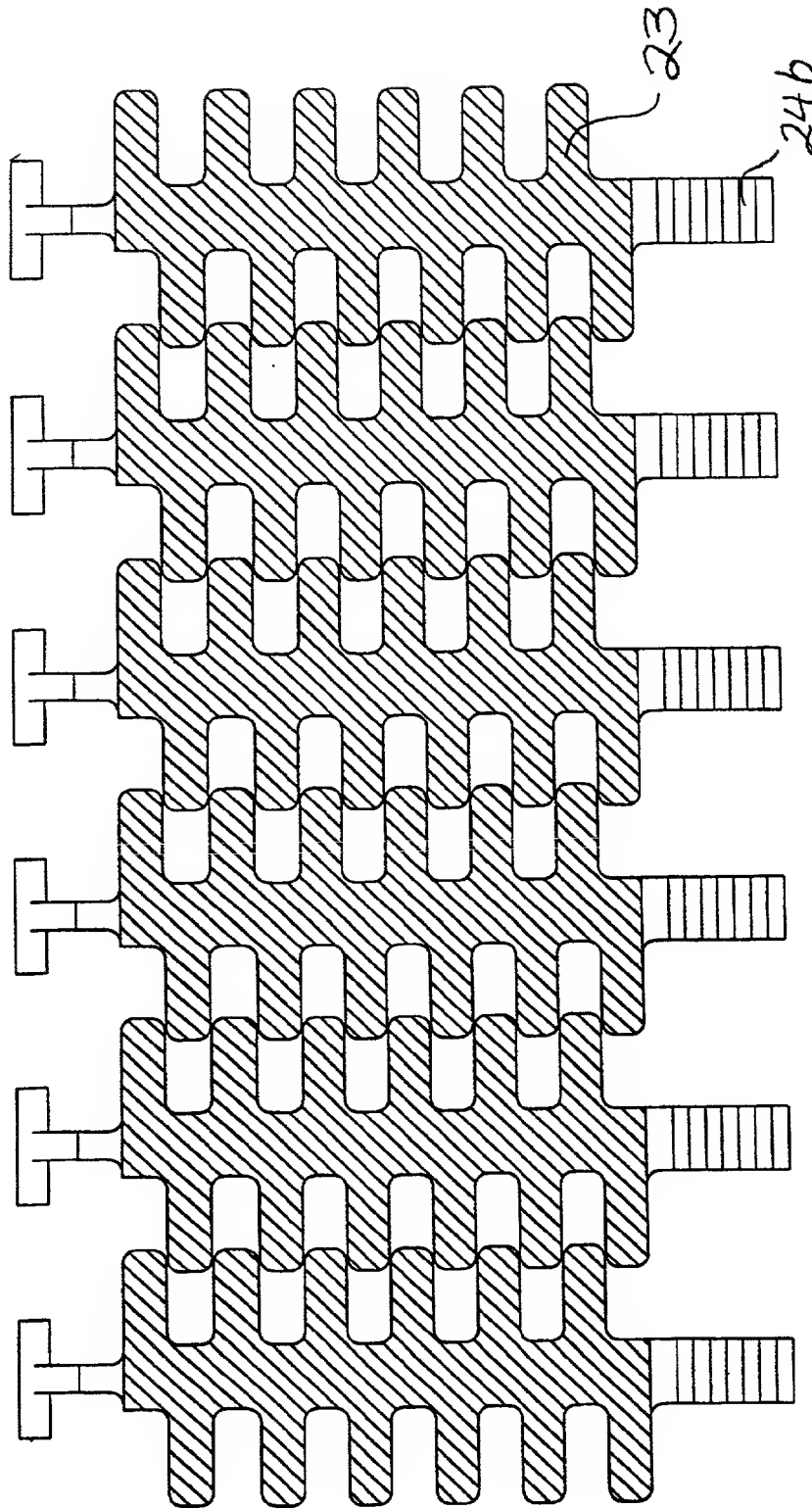


Fig. 6



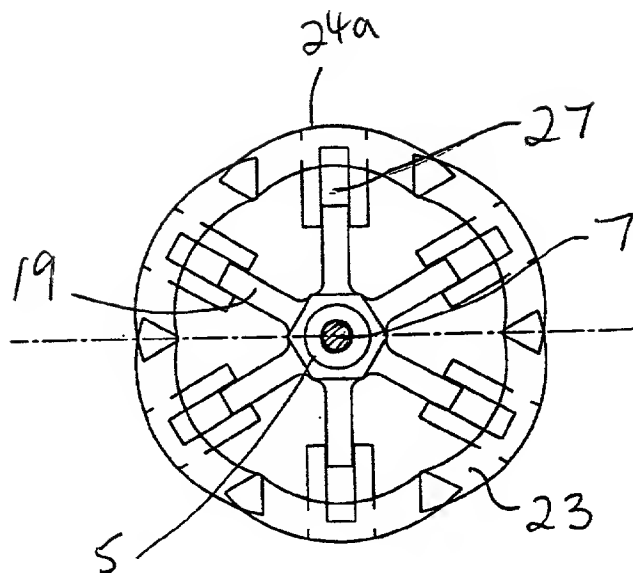


Fig. 7a

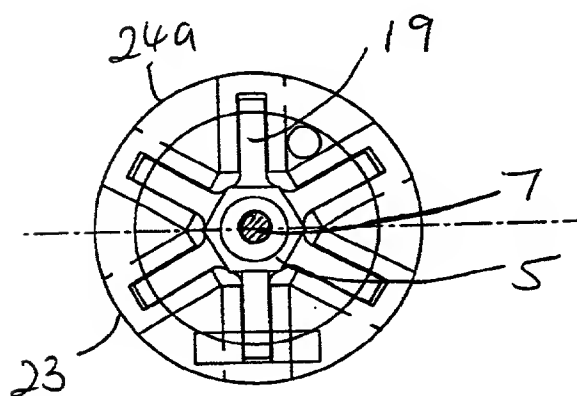
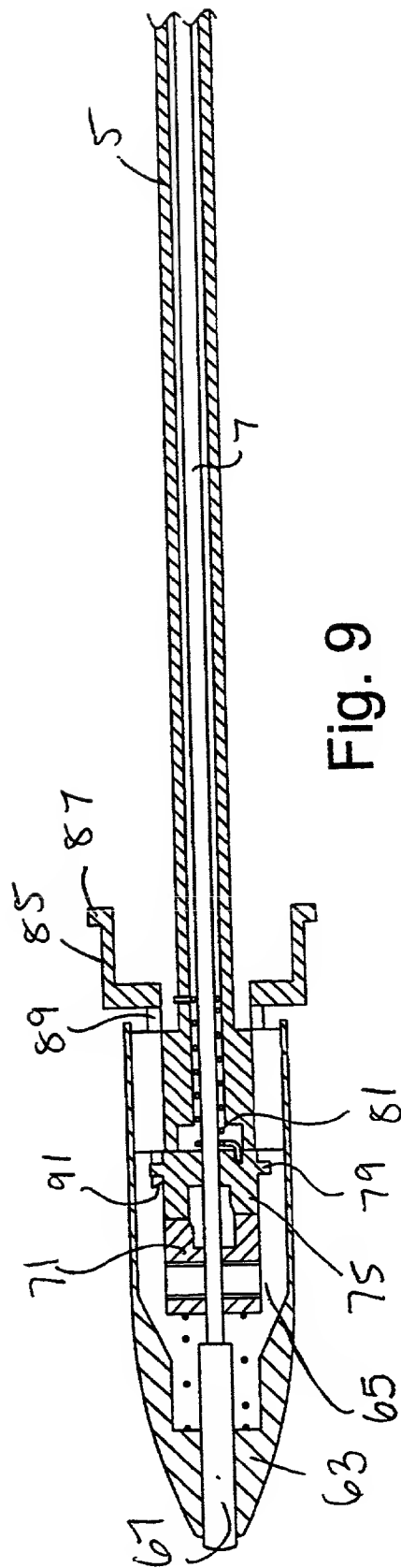
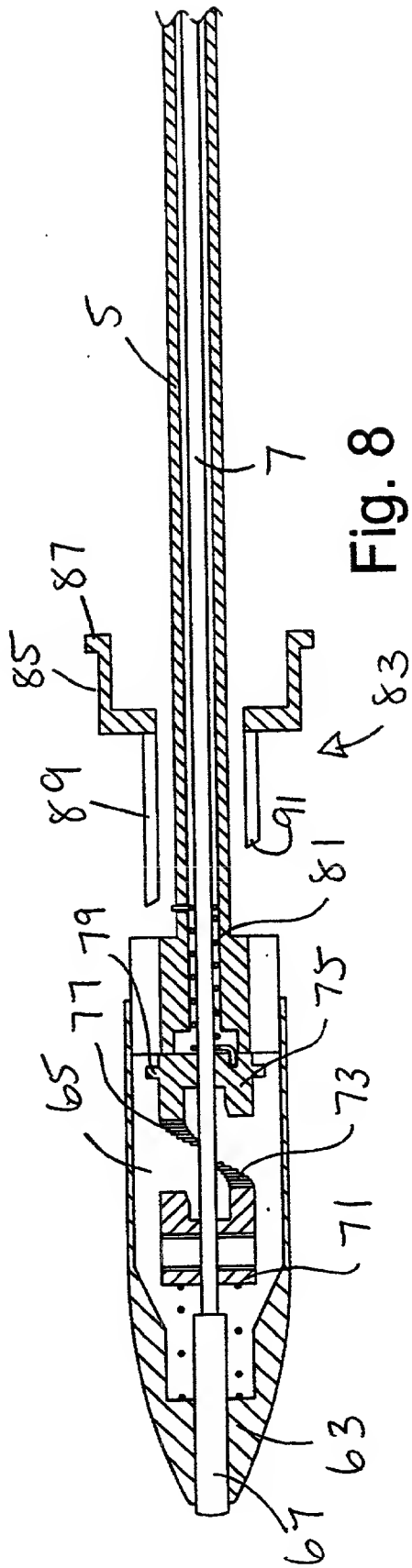


Fig. 7b



## USA

## DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: Actuating and Locking Mechanism for a Surgical Tool

which is described and claimed in:

☐ the attached specification

☐ the specification in application Serial No. \_\_\_\_\_

☐ PCT International Application No. \_\_\_\_\_

(if applicable) and amended on \_\_\_\_\_

and on \_\_\_\_\_

filed \_\_\_\_\_

filed 4 February 2000

under Article 19 PCT

under Article 34 PCT

I hereby state that I have reviewed and understand the contents of the above-identified application specification, including the claims, as amended by any amendment specifically referred to herein.

I acknowledge the duty to disclose all information known to me that is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Number	Country	Date Filed	Priority Claimed
<u>9902647.8</u>	<u>United Kingdom</u>	<u>5 February 1999</u>	<input type="checkbox"/> yes <input type="checkbox"/> no
_____	_____	_____	<input type="checkbox"/> yes <input type="checkbox"/> no
_____	_____	_____	<input type="checkbox"/> yes <input type="checkbox"/> no
_____	_____	_____	<input type="checkbox"/> yes <input type="checkbox"/> no

I hereby claim the benefit under Title 35, United States Code §1.20, of the United States Application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose all information that is material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56, and which became available to me between the filing date of the prior application and the national or PCT international filing date of this application:

Application Serial No.	Filing Date	Status (patented, pending, abandoned)
_____	_____	_____
_____	_____	_____

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

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Citizenship:

Post Office Address:

Signature of first inventor:

Date:

6.8.01

Signature of second inventor:

Date:

31. 7. 01.

Signature of third inventor:

Date:

Signature of fourth inventor:

Date:

Signature of fifth inventor:

Date:

Signature of sixth inventor:

Date: